

WHAT IS CLAIMED IS:

- 1 1. A manufacturing system comprising:
2 a plurality of industrial controllers, each industrial controller
3 executing logic establishing at least one queue having a queue length, each industrial
4 controller implementing a time clock, each industrial controller operative detect an
5 event, associate a preassigned event code with the event, read the time clock to
6 obtain an event time, and store as an event record the preassigned event code
7 associated with the event time in the queue;
8 a data communication network interconnecting the plurality of
9 industrial controllers;
10 a group computer connected to the data communication network, the
11 group computer operative to
12 (a) synchronize the time clock in each of the plurality of
13 industrial controllers to the same time at a particular instant of time,
14 (b) for each queue in each industrial controller, store a queue
15 scan rate value and the queue length,
16 (c) for each queue in each industrial controller, retrieve at least
17 one of the event records held in that queue at a periodic interval
18 based on the scan rate value for that queue,
19 (d) accumulate event records retrieved from the plurality of
20 industrial controllers, and
21 (e) periodically forward the accumulated event records; and
22 a server in communication with the group computer, the server
23 operative to receive the forwarded accumulated event records and to store the
24 received event records for access by user interface programs.
- 1 2. The system of claim 1 wherein the group computer leaves
2 each industrial controller in substantially the same state after retrieving event
3 records from any queue maintained by the industrial controller.
- 1 3. The system of claim 2 wherein the group computer is further
2 operative to remove duplicate event records retrieved from each queue.

1 4. The system of claim 2 wherein, for each queue, the group
2 computer compares a set of recently retrieved event records with a set of event
3 records retrieved from at least one preceding scan to determine if any duplicate
4 event records were retrieved.

1 5. The system of claim 4 wherein the group computer
2 dynamically adjusts the queue scan rate value based on the comparison of the set of
3 recently retrieved event records and the set of event records retrieved from at least
4 one preceding scan.

1 6. The system of claim 1 wherein the group computer
2 dynamically adjusts the queue length based on a comparison of a set of recently
3 retrieved event records and a set of event records retrieved from at least one
4 preceding scan.

1 7. The system of claim 1 wherein each queue is emptied by the
2 operation of retrieving all event records held in that queue, each industrial controller
3 further operative to store a queue overflow event in the queue if the queue
4 overflows.

1 8. The system of claim 1 wherein, for each queue; the group
2 computer is operative to dynamically adjust the queue scan rate value for that queue
3 if a queue overflow event is retrieved from that queue.

1 9. The system of claim 1 further comprising additional groups
2 of industrial controllers, each group of industrial controllers interconnected by a
3 data communication network to which is connected a unique group computer, each
4 group computer operative to periodically forward accumulated event records to the
5 server.

1 10. The system of claim 1 wherein each industrial controller is
2 operative to store a recipe change and a time stamp for the recipe change as an event
3 record.

1 11. The system of claim 1 wherein the logic establishing at least
2 one queue is common to all industrial controllers of a similar type and wherein logic
3 operative to detect an event is unique to each industrial controller application.

1 12. A method of monitoring industrial equipment divided into a
2 plurality of groups, wherein at least one industrial controller is assigned to each
3 group, each industrial controller monitoring conditions of at least a portion of the
4 industrial equipment assigned to the group, the method comprising:

5 establishing a plurality of queues for each group, each queue
6 operative to hold a number of event records, each queue established by logic within
7 one of the industrial controllers;

8 in each industrial controller, establishing logic to detect a
9 predetermined event and store an indication of the detected event associated with a
10 time stamp as an event record in a queue associated with the predetermined event;

11 for each group, interconnecting a group computer with each of the
12 at least one industrial controller in that group through a data communication
13 network;

14 in each group computer, establishing a scan rate for each queue in
15 that group, periodically reading the event records in each queue based on the scan
16 rate for that queue, and accumulating the event records for all queues in that group;
17 and

18 collecting the accumulated event records for each group computer in
19 a server.

1 13. The method of claim 12 wherein each queue is not changed
2 when read by the group computer.

1 14. The method of claim 13 wherein each group computer
2 compares a set of event records read at a first scan with another set of event records
3 read at a previous scan, the group computer removing any duplicate records found.

1 15. The method of claim 13 wherein the scan rate for each queue
2 is dynamically adjusted based on a comparison of event records read from the queue
3 at at least two different times.

1 16. The method of claim 13 wherein the number of event records
2 for each queue is dynamically adjusted based on a comparison of event records read
3 from the queue at at least two different times.

1 17. The method of claim 12 wherein each queue is cleared when
2 read by the group computer, the industrial controller further operative to store a
3 queue overflow event in the queue if the queue overflows.

1 18. The method of claim 17 wherein the scan rate for each queue
2 is dynamically adjusted based on reading at least one queue overflow event.

1 19. The method of claim 12 further comprising:
2 receiving an indication of a recipe change for at least a subset of the
3 industrial equipment; and
4 storing the indication of a recipe change as an event record.

1 20. A method of monitoring industrial equipment comprising:
2 detecting one of a predetermined set of events occurring in the
3 industrial equipment;
4 forming an event record by associating the detected event with a time
5 stamp;
6 pushing the event record onto a finite length queue initiated within
7 an industrial controller;
8 reading all event records held by the queue after an interval
9 determined as a scan rate;

10 discarding as a duplicate event record any event record matching a
 11 previously read event record; and
 12 dynamically determining the scan rate based on whether or not any
 13 duplicate event records are discarded.

1 21. A method of monitoring industrial equipment comprising:
 2 detecting one of a predetermined set of events occurring in the
 3 industrial equipment;
 4 forming an event record by associating the detected event with a time
 5 stamp;
 6 pushing the event record onto a finite length queue initiated within
 7 an industrial controller;
 8 pushing an overflow event record onto the queue if an overflow event
 9 is detected;
 10 reading and clearing all event records held by the queue after an
 11 interval determined as a scan rate; and
 12 dynamically determining the scan rate based on reading at least one
 13 overflow event.

1 22. A method of monitoring industrial equipment comprising:
 2 establishing a plurality of queues, each queue established in an
 3 industrial controller, each queue having its own scan rate;
 4 associating each of a plurality of events with an event label and one
 5 of the plurality of queues;
 6 detecting one of the plurality of events;
 7 storing the event label associated with the detected event together
 8 with a time stamp as an event record in the queue associated with the detected event;
 9 reading each queue periodically at a rate determined by the scan rate
 10 for that queue; and
 11 accumulating the event records from the plurality of queues.

1 23. The method of claim 22 further comprising automatically
 2 adjusting the scan rate of each queue based the event records read from that queue.